Rancho La Costa
Habitat Conservation Area

A Dedicated Natural Open Space System Set Aside as part
of the La Costa Villages, University Commons, and
Cassia Professional Offices Developments
and also includes the "Nelson", "Meadowlark" and "Copper Creek" parcels.

(CNLM No's: S016, S020, S022, S026, S036, S043 & S048)

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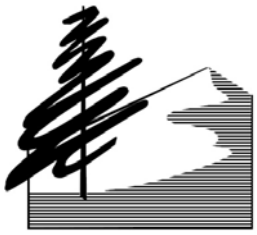

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I. INTRODUCTION AND SUMMARY

This annual work plan has been developed from the guidelines for goals and objectives set forth in the Habitat Management Plan for the Rancho La Costa Habitat Conservation Area (Plan) dated November 2011 (CNLM 2011). The Plan includes management requirements agreed to by the United States Fish and Wildlife Service (USFWS) and California Department of Fish and Game (CDFG), and additional management activities that the Center for Natural Lands Management (Center or CNLM) has determined are appropriate to protect and maintain the natural resources in perpetuity. The Center holds fee title and conservation easements (CE) to the Rancho La Costa Habitat Conservation Area (HCA) and performs or oversees the tasks identified in the Plan.

The HCA covers several areas which were dedicated to the Center for long-term management from the La Costa Villages, University Commons, and Cassia Professional Offices (Cassia) developments. Each development dedicated several parcels that have been identified in the past by various names or associations. The La Costa Villages project dedicated parcels referred to as the Oaks, Ridges, Greens, Choumas-Pappas, and Alemir, of which the former three are located in the City of Carlsbad, and the latter two are located in the County of San Diego. The University Commons project dedicated parcels referred to as the "on-site parcels", Frank's Peak, Pfau (CE), Huff, Wilern, Winston, Setter, and Elfin Forest (CE). The Elfin Forest parcels are located both on-site (San Marcos) and within the County of San Diego. The Setter parcel is within the County of San Diego. All the other University Commons parcels are located within the City of San Marcos. The Nelson parcel, located in San Diego County, was purchased by the National Fish and Wildlife Foundation and deeded to the Center. The "Cassia" parcel was added in 2007 and is located adjacent to the "Greens" parcel in Carlsbad. The Meadowlark parcel (acquired via the Environmental Trust bankruptcy) was added in early 2009 and is located in the City of San Marcos between the Wilern and on-site University Commons parcels. In October of 2011, the Copper Creek property was added this HCA. Copper Creek (formerly known at the "Perkins" or "Conservation Fund Unit") was purchased by the Wildlife Conservation Board from the Conservation Fund.

CNLM holds fee title to most parcels (with one remaining to be transferred), and is also managing properties pursuant to six recorded conservation easements (CE). CNLM is in escrow for the last parcel. The developer had not transferred fee title to this last parcel so they could work out easement issues prior to transfer. Stewardship funding to manage all of the HCA parcels have been received, except for the Copper Creek parcel, for which partial funding has been received (see budget section). Management commenced in January 2002 for about one half of the total property with management of the additional acreage commencing between January 2002 and early 2009.

The purpose of this work plan is to identify the tasks and budget required to complete the management activities for this fiscal year. The fiscal year encompasses the period from October 1, 2011 through September 30, 2012. Unless otherwise stated, all tasks will be performed by the Center's Regional Preserve Manager, Preserve Managers, Jessica Vinje and Patrick McConnell, and Rangers, Roberto Bejar and Zadok Othniel.

Summary of Tasks and Goals for the Fiscal Year:

- Replace and install signs, fix and replace fencing as necessary.
- Note all animal species observed and map locations of any sensitive species.
- Monitor wildlife corridors using digital cameras
- Map vegetation communities (except the Greens) and update the vegetation Geographic Information System (GIS) database.
- Conduct vegetation sampling at permanent plots within the thread-leaf brodiaea (*Brodiaea filifolia*) populations.
- Count individuals, perform a habitat assessment, and control weeds in the San Diego thornmint (*Acanthomintha ilicifolia*) occurrence.
- Collect San Diego thornmint plant material for the genetic studies that will be conducted using funds obtained through the San Diego Association of Governments (SanDAG) Environmental Mitigation Program (EMP).
- Continue to survey for San Diego marsh-elder (*Iva hayesiana*) and southwestern spiny rush (*Juncus acutus* ssp. *leopoldii*).
- Collect data from vegetation monitoring plots within coastal sage scrub (CSS) located on the HCA.
- Count the Orcutt's hazardia (*Hazardia orcuttii*) transplanted container plants on the Greens and survey for seedlings.
- Remove non-native plant species, especially perennial pepper weed (*Lepidium latifolium*), onion weed (*Asphodelus fistulosus*), Ward's weed (*Carrichtera annua*), pampas grass (*Cortaderia* spp.), and tamarisk (*Tamarix* spp.) using Center funds and funds received from the TransNet Grant and the Vallecitos Water District.
- Control weeds growing in the transplanted Orcutt's brodiaea (*Brodiaea orcuttii*) population on the Winston parcel using an Asteraceae-specific herbicide to control the Italian thistle (*Carduus pycnocephalus*).
- Coordinate with Homeowner's Associations (HOAs) on HCA issues and coordinate public outreach events and prepare public outreach literature.
- Coordinate with trail volunteers, Eagle Scouts, and the San Diego Mountain Biking Association to accomplish HCA projects.
- Mow and clear fuel breaks.
- Patrol and conduct site enforcement on a regular basis.
- Report and describe data collected and management actions taken on the HCA to the regulatory agencies.
- Conduct CE compliance monitoring and prepare reports.
- Provide an accounting of funds to be spent in the next fiscal year.

Appendix 1 identifies the approximate schedule of field work throughout the fiscal year. Maps of the HCA are located in Appendix 2.

II. MANAGEMENT ACTIVITIES

The following sections identify and describe the activities to be performed during this fiscal year. Based upon the Property Analysis Record© (*PAR*) developed by the Center to outline long-term management tasks and costs, management activities for the HCA can be categorized into several groups: Capital Improvements, Biological Surveys, Habitat Maintenance and Restoration, Public Services, Reporting, Office Maintenance, and Operations. Each of these categories will be discussed below.

A. CAPITAL IMPROVEMENTS

Fencing and signing are the only capital improvements to be undertaken during the upcoming fiscal year.

1. Fencing. The Center will construct barbed wire fencing or other appropriate types of fencing in several locations throughout the HCA as needed in areas where the public is trespassing.

2. Signing. Center signs have been posted at all of the major access points to the HCA. Additional signs will be installed in other strategic locations throughout the HCA. Vandalized signs will be replaced. Each sign explains that the HCA is a dedicated open space, and that off-highway vehicle (OHV) activity, dumping, and shooting are prohibited.

B. BIOLOGICAL SURVEYS

The following section outlines monitoring activities planned for the next fiscal year. All data will be entered or stored in GIS and/or MSAccess/excel databases. A brief description of monitoring activities outlined by taxa is provided below.

1. Vegetation Sampling in Thread-leaved Brodiaea Populations

One of the Center's goals is to collect information on the grassland areas that are known to support thread-leaf brodiaea. The Center's objective is to maintain a healthy, stable population of thread-leaf brodiaea and decrease the percent cover of non-native grasses, specifically purple-false brome (*Brachypodium distachyon*). Appendix 3 (Research Proposal for the Herbicide Application of *Fusilade* II to thread-leaf brodiaea (*Brodiaea filifolia*) describes the vegetation sampling proposal and recent methodology modifications. The fifth year of data collection occurred during the 2010-2011 fiscal year and the sixth year of data collection will occur during this upcoming fiscal year. The methodology will differ somewhat from that described in Appendix 3 in that only vegetative and flowering count data will be collected this upcoming fiscal year. Although the study will continue for one or more years, the principle objective has been reached: evidence has been provided that *Fusilade* II is an effective herbicide for controlling non-native grasses in occupied thread-leaf brodiaea habitat and that, in the short run; *Fusilade* II does not appear to harm or kill thread-leaf brodiaea. The Center will continue to

count vegetative and flowering thread-leaf brodiaea to determine if there are any long-term negative effects from the use of *Fusilade* II in occupied thread-leaf brodiaea habitat.

2. Vegetation Sampling in San Diego Thornmint Occurrences

A monitoring methodology was established to monitor the San Diego thornmint occurrence located at the Greens during the 2008-2009 fiscal year. This methodology was again implemented during the 2009-2010 and 2010-2011 fiscal years. A stratified random sampling methodology was employed within the occurrence to collect data on percent cover, abundance, and diversity of native and non-native plant species. Monitoring transects were randomly placed within the previously demarcated boundaries of the occurrence and quadrats were randomly placed along these transects and data were collected within each quadrat. This monitoring will occur again during this next fiscal year. Removal of non-native grass and forb species will occur just prior to data collection (this was done in 2011 as well) and the methodology will be repeated each year to track the changes in percent cover, abundance and diversity in response to weed management in the occupied habitat. Management of the occurrence will be modified if necessary based on the results of the annual monitoring.

3. Long-term Coastal Sage Scrub (CSS) Monitoring

As per the Plan, the Center has a goal of monitoring long-term CSS monitoring plots to track changes in the CSS community. In 2005, we set up vegetation transects stratified by fire history, distance from edge and vegetation sub-association. We used those data to direct our current action and plan (Appendix 4). We established the majority of our CSS plots per the CSS monitoring plan during 2008, 2009, 2010, and 2011 and we finished monitoring all of the established plots during the spring of 2011. This upcoming fiscal year, we will likely establish a few more plots and collect data from these new plots. We will also collect data from the plots where we first collected data in 2008. We may also collect data from the plots where data were collected in 2009. See Appendix 4 for the most recent methodology modifications.

4. Sensitive Plant Species

The HCA supports more than 10 sensitive plant species. The location and abundance of each of these species was mapped and counted in 2003 and some were again mapped and counted in 2008. During this upcoming fiscal year, we will monitor the thread-leaf brodiaea and San Diego thornmint occurrences at the Greens and conduct our vegetation sampling projects within the occupied habitat for both of these species (discussed in Section B.1. and B.2.) and we will count the Orcutt's hazardia transplanted population at the Greens and survey for seedlings within this population. Lastly, we will continue to survey for and map San Diego marsh-elder and southwestern spiny rush as these surveys were not completed last fiscal year. Surveys were initiated for these species in 2008, but never finalized. Additionally, during all patrol and survey activities, a plant species list will be created and added to the master plant species list at the end of the year.

5. Vegetation Mapping

Vegetation communities were mapped for the Greens portion of the HCA in 2010 and all other areas were mapped as part of the original project developments (citations unavailable). In order to detect if any changes have occurred in the spatial extent of DCSS and other vegetation communities, a new vegetation map is required. This vegetation map will also aid in pre-and post comparisons should a fire burn the HCA.

The vegetation communities will be mapped using the Vegetation Classification Manual for Western San Diego County (Sproul, Keeler-Wolf, Gordon-Reedy, Dunn, Klein, & Harper, 2011). The minimum mapping unit should be ¼ acre; however a finer scale can be used. Historical aerials will be compared to newer aerials to look for any changes within these communities.

6. Wildlife

The Center will monitor wildlife movement in several locations (east of Rancho Santa Fe Avenue, on the Huff parcel in Copper Canyon, and possibly on the Elfin Forest off-site parcel) in the HCA using digital remote sensing cameras. These cameras will be placed in strategic locations throughout the HCA that were chosen during previous years. The Center will be able to track wildlife movement through designated and potential wildlife corridors using these cameras. Additionally, during all patrol and survey activities, a wildlife species list will be created and added to the master wildlife species list at the end of the year.

C. GENETIC STUDIES

In mid-2011, CNLM was awarded a SanDAG EMP grant to conduct a range-wide genetic and common garden study of San Diego thornmint throughout San Diego County. As such, in 2012, CNLM will collect San Diego thornmint plant parts and seeds from the San Diego thornmint occurrence to use in the studies. The methodology for the genetic and common garden studies will be determined by the CNLM Science Director. The required permits and permissions will be obtained prior to any ACIL collections.

D. HABITAT MAINTENANCE AND RESTORATION

1. **Habitat maintenance.** Habitat maintenance will continue during this upcoming fiscal year. Since 2002, many non-native plants and acreage infested by non-native plants has been treated by CNLM. Non-native plants will continue to be treated by Center staff this upcoming fiscal year. The Center will use money allocated from our budgets to treat the non-native plants and money received from the TransNet Environmental Mitigation Program and funds received from the Vallecitos Water District and Morrow Development (Morrow).

The following non-native plant removal projects will occur in the upcoming fiscal year and will be carried out using money allocated through the Center budgeting process. We will:

- Drill and fill, or cut and stump spray, eucalyptus (*Eucalyptus* spp.) trees in various locations throughout the HCA.
- Treat fennel (*Foeniculum vulgare*), artichoke thistle (*Cynara cardunculus*), pampas grass, tamarisk, ice plant (*Carpobrotus* spp.), onion weed (*Asphodelus fistulosus*), and tree tobacco (*Nicotiana glauca*) at the Greens and in other various locations throughout the HCA.
- Continue to treat about ½ acre of pampas grass at the Brouwer parcel and all of the pampas grass located on the Greens parcel as resprouts are observed.
- Treat fountain grass (*Pennisetum setaceum*), castor bean (*Ricinus communis*), acacia (*Acacia* spp.), and blue-eye cape-marigold (*Dimorphotheca sinuata*) along the old Rancho Santa Fe Road.
- Treat fountain grass located north of the Brouwer Quarry.
- Use an Asteraceae-specific herbicide to treat Italian thistle in the Orcutt's brodiaea habitat at the Winston parcel and the thread-leaf brodiaea population at the Greens (population located closest to the Research Study Macroplot #1).
- Control using post-emergent spot applications and hand pulling, the non-native annual weeds that are growing in the San Diego thornmint occurrence at the Greens prior to collecting quantitative monitoring data.

Transnet Grant – Weeds

In early 2009, the Center applied for grant funding through the TransNet Environmental Mitigation Program. The Center was awarded approximately $50,000.00 to continue weed treatments at the Greens and Meadowlark parcels over the next five years. The following weeds will be treated during this upcoming fiscal year: perennial pepper weed (Greens population), onion weed (Meadowlark population), Ward's weed (Greens population), and perennial veldt grass (*Ehrharta calycina*) (Greens population and the old Rancho Santa Fe population if funds permit).

Vallecitos Water District – Weeds and Restoration

The Center received compensatory funds from the Vallecitos Water District for wetland/riparian vegetation impacts at the North County Habitat Bank (Center-owned HCA in Carlsbad) in 2009. As part of the agency mitigation requirements, Vallecitos Water District was required to remove all non-native riparian plants from a wetland area located on the Greens parcel north and west of the Poinsettia and Alicante Avenue intersection. Additionally, they are required to enhance the wetland area by planning arroyo willow (*Salix lasiolepis*) cuttings in the same

area where non-native plant removal occurred. The non-native plant removal commenced in October 2009 and the arroyo willow cuttings were planted shortly thereafter. The Center has monitored the non-native plant treatments and the arroyo willow growth. The remaining funding will be used over the next couple of years to continue to treat non-native plants in the wetland enhancement area on the Greens.

Morrow Development

Morrow Development was required to give $4,000.00 to CNLM to continue to treat resprouting exotic trees in Box Canyon including, but not limited to, acacia (*Acacia* spp.), shamal ash (*Fraxinus uhdei*), pepper trees (Schinus spp.), and eucalyptus (*Eucalyptus* ssp.). Morrow Development first treated all exotic trees in Box Canyon in summer 2011 for a compensatory mitigation project that did not meet success criteria on the Greens parcel. The regulatory agencies determined that treating all exotic trees in Box Canyon and providing CNLM with money to continue to treat resprouting exotic trees for the next two to three years, would be sufficient for Morrow to receive release from their regulatory permits. The $4,000.00 will also be used to treat any pampas grass resprouts that are located throughout Box Canyon and in the tributaries to Box Canyon.

2. **Habitat Restoration** The Huff and Hubbard Restoration sites have been completed and no further remedial measures are necessary at this point, however, there are remaining funds for weed treatments to occur at the Huff site.

   During the spring and summer of 2011, City Ventures, worked with CNLM staff to choose restoration and enhancement locations on the Greens parcel as mitigation for a City Ventures Development planned for the southwestern corner of El Camino Real and Poinsettia Avenue. City Ventures is mitigating for project impacts on the Greens parcel because no other mitigation opportunities could be located within the Coastal Zone. As such, the regulatory agencies decided that mitigation could occur just outside of the Coastal Zone on the Greens parcel.

   During this upcoming fiscal year, CNLM staff will continue to work with City Ventures and their consultant, Jim Whalen and Associates, to implement the restoration project at the Greens.

E. FUEL ZONES

CNLM will mow and clear several fuel management areas adjacent to homes that border the HCA. We will be using contract crews to accomplish this work.

F. PUBLIC SERVICES

Public services activities include the patrolling of the HCA and the response to emergencies. However, other opportunities for public service will undoubtedly be forthcoming during the year, such as a spring nature walk, local groups and individuals interested in volunteering labor for HCA projects, and class field trips from local schools. We will accommodate these activities whenever possible.

1. **Patrols.** Patrols will be performed approximately once to twice per week.

2. **Emergency Response.** Staff time has been allocated from the current budget for management to respond to emergencies on the HCA. Such emergencies could include response to wildfires, wildlife problems reported by neighbors, and trespass.

3. **Nature Walks/Outreach/Trails**. During this fiscal year, the Center will be blocking off unwanted and illegal trails on Denk Mountain and in the Box Canyon area. We may also be working with a local mountain biking group (San Diego Mountain Biking Association) to maintain existing trails and with HOAs on HCA issues. Additionally, we will be preparing public outreach literature for the HOAs and lastly, we will be working with local Eagle Scouts to accomplish HCA projects.

G. CONSERVATION EASEMENT COMPLIANCE

Current CE's include the Pfau CE near Frank's peak, Lot 8 of University Commons and the Elfin on- and off-site properties. The HCA Manager will monitor compliance of all areas of the CE to ensure the conservation values are maintained in perpetuity. Center practices for monitoring and reporting on CEs is derived from the CE agreement, CNLM's CE enforcement policy, and Land Trust Alliance standards (through which CNLM is an accredited land trust). A baseline report is prepared on a preserve, or on the portion where the CE exists, and then annual monitoring (or as often as stipulated in the CE) occurs to document any changes in the baseline condition. This process insures CE's are being managed appropriately, and ensures continuity of process. Compliance visits are to be carried out during the later portion of the management year, and will be appended to each year's annual report.

H. REPORTING

Activities included within reporting requirements include the management of the HCA's database/GIS system, the photo-documentation stations, and the production of various status reports to the USFWS, CDFG, and Center administration.

1. Database/GIS Management

Data derived from routine patrols and photo-documentation will be entered into and maintained in the HCA's existing database/GIS system. Additionally, the vegetation GIS layer will be updated based on the new vegetation maps and metadata will be added because currently, there are no metadata associated with the GIS vegetation layer. Efforts will be made to coordinate and standardize database fields and parameters with other reserves.

2. Reports

a. **Year-End/Agency Reports** By December 2012, a year-end report will be prepared by the Preserve Manager detailing the results of the year's management activities. This report will include recommendations for the continuation of various activities for the following fiscal year and will be submitted to the County of San Diego, City's of San Marcos and Carlsbad, the USFWS and the CDFG as required under permit reporting conditions.

b. **Annual Work Plan** The work plan for the 2012-2013 fiscal year will be formulated by October, 2012 and will be based upon experiences during previous years' operations. This work plan will be submitted to the County of San Diego, City's of San Marcos and Carlsbad, USFWS and CDFG.

c. **Management Plan** The management plan for the HCA was updated in November 2011 and will be submitted to the County, City's of San Marcos and Carlsbad and the wildlife agencies by the end of 2011.

I. OFFICE MAINTENANCE

HCA Management will maintain offices in an organized manner to facilitate maximum efficiency. This section of the budget includes outlays for general office work, utilities, and telephones, among other items/tasks.

J. OPERATIONS

Operations include the training and professional growth of Preserve Management personnel and inspection of the HCA by Center administration. Funds have been allocated in the current budget for both the Preserve Manager to attend an organization-wide Retreat, management-related training or seminars, and/or conferences during the fiscal year. Also included within this category of activity is the conduction of employee reviews.

III. WORKLOAD AND BUDGETS

A. SUPERVISION & STAFFING

The Preserve Managers and Rangers will be supervised by the San Diego Regional Manger, Markus Spiegelberg, and by the Center's Director of Conservation Science (DCS), Dr. Deborah Rogers. Tasks and priorities will be coordinated by the San Diego Regional Manager and approved by the DCS. Additionally, Dr. Rogers will assist with document review and scientific research conducted on Center preserves.

B. BUDGETING

The total budget for this fiscal year is (based on the interest generated from six endowments and the initial and capital from one project, (Cassia Professional Offices): Nelson, La Costa Villages, University Commons (Brookfield Development), Cassia Professional Offices, Elfin Forest (Scandia Development portion of University Commons), and Meadowlark are: $3,350, $68,817, $30,560, $5,188, $4,301, and $447.00 respectively. A budget for the Copper Creek property has not yet been developed. The Center received $50,000 as part of the purchase agreement, and will receive a total of about $850,000 in Initial and Capital, and Endowment in 4 separate, but equal, payments from the City of Carlsbad. The City's contribution fulfills some of their HMP requirements which was approved by the wildlife agencies. Every effort will be made by the Center to allocate time and expenses according to these estimated budgets.

IV. REFERENCES

CNLM 2011. Rancho La Costa Habitat Conservation Area Habitat Management Plan 2011-2015. November, 2011.

Sproul, F., T. Keeler-Wolf, P. Gordon-Reedy, J. Dunn, A. Klein, and K. Harper. 2011. Vegetation classification manual for western San Diego County. SANDAG, CA.

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V. APPENDICES

Appendix 1 - Task Schedule

Task	October-December 2011	January-March 2012	April- June 2012	July-September 2012
Non-native Plant Removal	X	X	X	X
Rare Plant Surveys; Collection of Genetic Research Plant Material; and Rare Plant Vegetation Analyses		X	X	
Establish and Monitor CSS Vegetation Plots		X	X	
Wildlife Monitoring	X	X	X	X
Restoration and Maintenance Activities	X	X	X	X
Clear Fuel Breaks			X	
Report and Plan Preparation; GIS Database Work; Vegetation Mapping; Conservation Easement Compliance	X			X
Patrol HCA; Public Outreach	X	X	X	X

Appendix 2 - HCA Location Maps

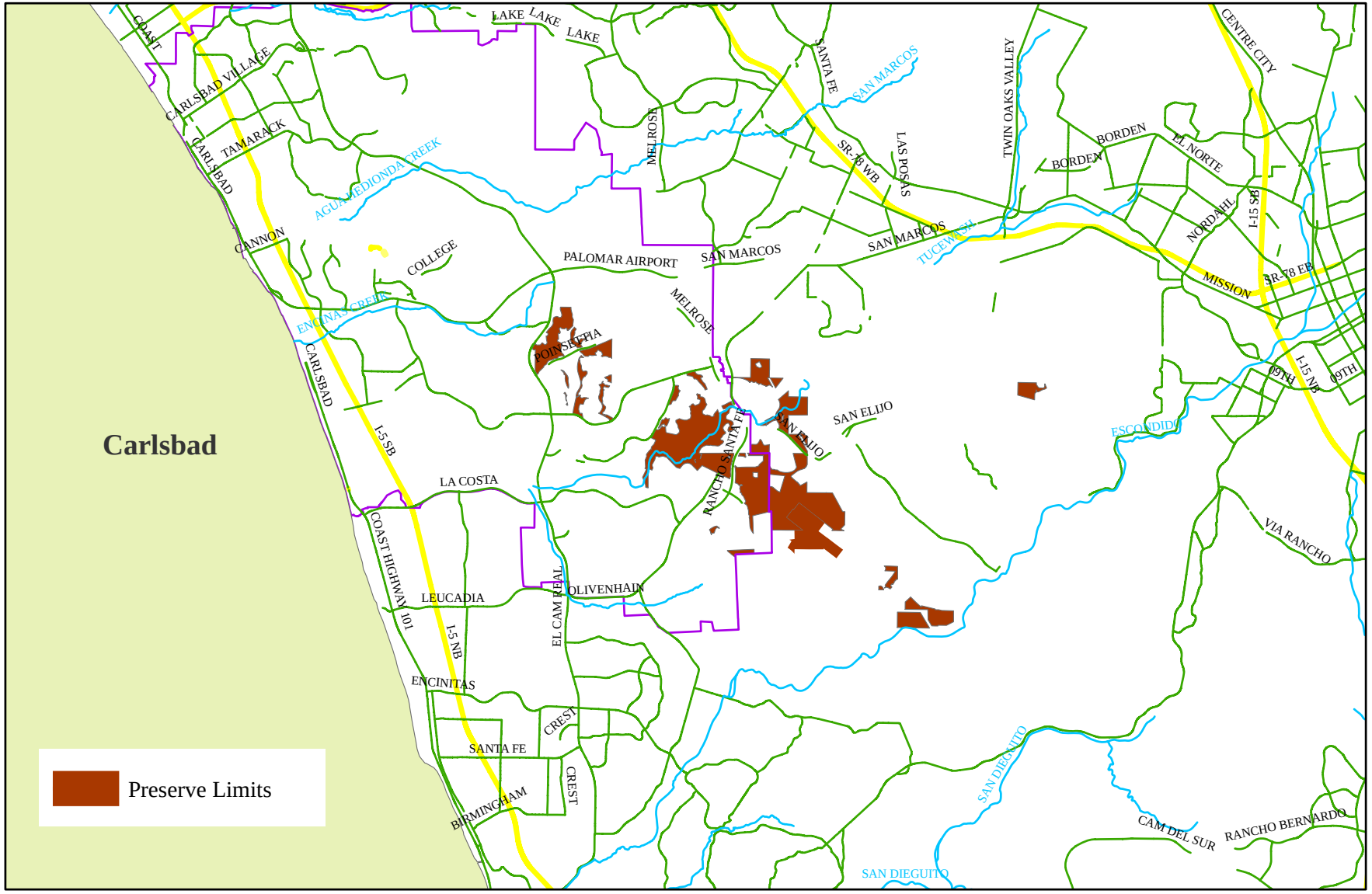

Figure 1. Preserve Location

Rancho La Costa Habitat Conservation Area- San Diego, California

Center for Natural Lands Management

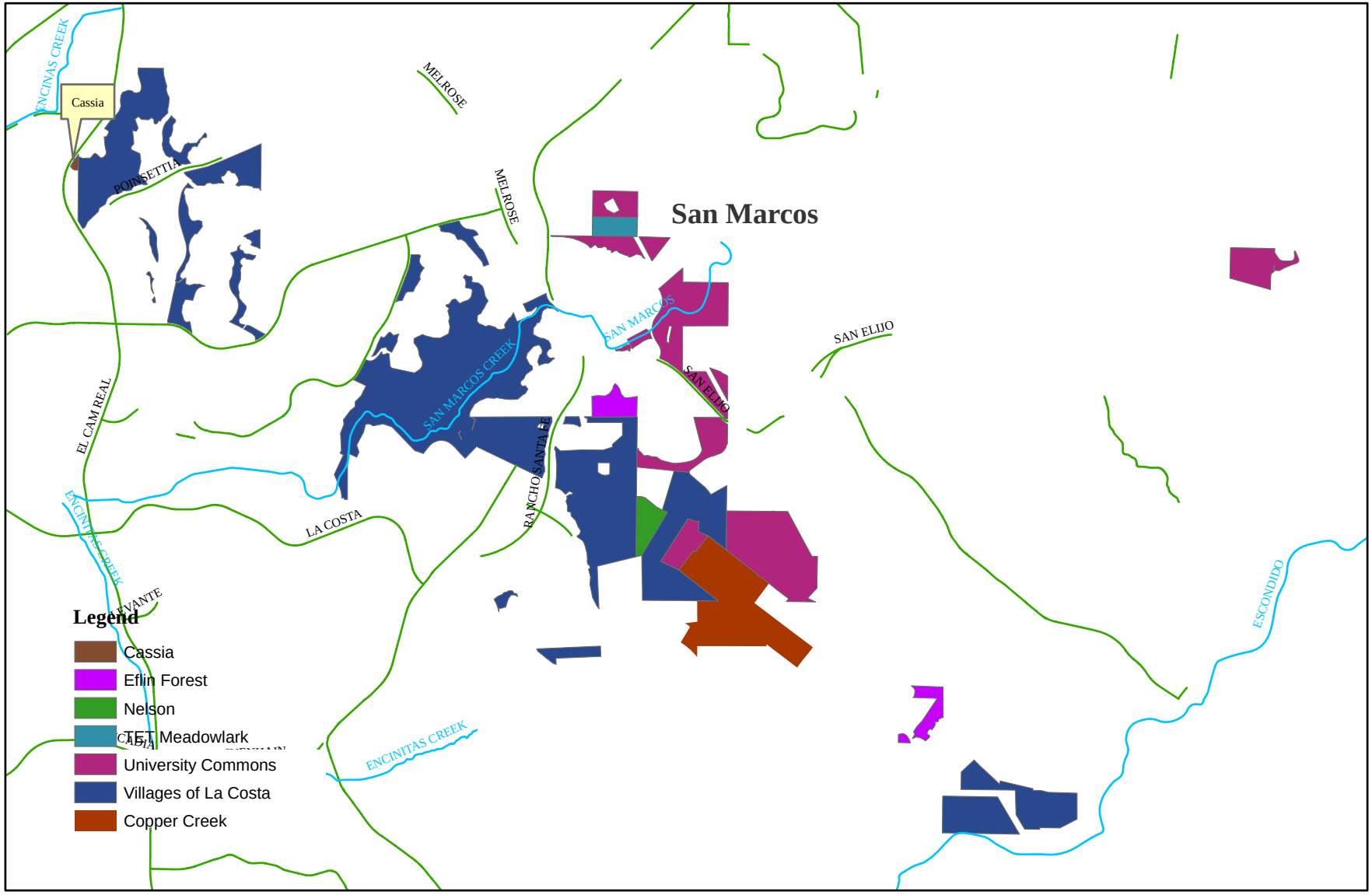

Figure 2. Preserve Vicinity

4,100 2,050 0 4,100 Feet

Rancho La Costa Habitat Conservation Area- San Diego, California

Center for Natural Lands Management

Appendix 3 - Thread-leaf Brodiaea (*Brodiaea filifolia*) Revised Research Methodology

Thread-leaf Brodiaea (*Brodiaea filifolia*) Research Study Methodology (Revised in 2009 and 2010)

Survey Design and Sampling Methodology

CNLM applied *Fusilade* II to one of the established subplots (described in Survey Design and Sampling Methodology below) in February 2008 after receiving permission from the CDFG. This subplot contained approximately 50 thread-leaf brodiaea (BRFIL). In 2009, CNLM received permission from CDFG to apply *Fusilade* II to eight subplots after *Fusilade* II was found to not impact (kill) BRFIL after the 2008 application.

Fusilade II application rates were based on backpack sprayer calibration and the area that was treated. The area treated in one Macroplot was 80 square meters. The application rate for one Macroplot was as follows: 0.463 ounces of *Fusilade* II + 1.84 gallons of water + 1 ½ tablespoon of adjuvent (Activator 90).

Three Macroplots (Macroplots #1 through #3) were established at the Greens in February 2007. Each Macroplot was placed in areas known to support BRFIL. These Macroplots were placed across the slope topography (perpendicular to the slopes). A balanced randomized complete block design was used to stratify the treatments. Each Macroplot contains sixteen subplots, with four replicates of each treatment. Each subplot occupies an area of 1 meter by 10 meters. These rectangular belt subplots were chosen to better capture the clumped distribution of BRFIL. The treatments consisted of: 1) *Fusilade* II application 2) *Fusilade* II application plus dethatching of dried litter material 3) Dethatching of dried litter material only and 4) control (no *Fusilade* II application or dethatching). Macroplot 2 was removed from the study in 2010, thus no data will be analyzed for that Macroplot in the future.

Monitoring occurs two times per year, once to capture vegetative BRFIL (February data collection) and once to capture flowering BRFIL (May data collection). This helps to determine the true population of BRFIL in the study areas since less than 10-percent of the true population is estimated to bloom in any given year. It also allows us to assess the effect of *Fusilade* II on the vegetative portion of BRFIL.

The data collection will span a seven-year time frame to account for weather variation and fluctuation. The first two years (2007 and 2008) are pilot study years. Data collection and *Fusilade* II application to one subplot occurred in early 2008, as mentioned above. *Fusilade* II was applied to all eight subplots in Macroplot 3 in early 2009. In 2010, *Fusilade* II was applied to all 16 treatment plots (eight in Macroplot 1 and eight in Macroplot 3) and in 2011; *Fusilade* II was applied only to Marcoplot 1. Eight total years of data collection will occur with modifications to the sampling objectives and/or sampling methodology, if necessary, after assessing the results of the first two pilot years.

Within each subplot a direct vegetative count of BRFIL was conducted in February 2007 and in February 2008. Since counting vegetative BRFIL was extremely time consuming

and cost prohibitory, estimations were made instead during the 2009, 2010 and 2011 vegetative surveys. To obtain the estimation, a 0.5 by 1 meter quadrat was placed every other meter along the 10-meter tape that was placed in the middle of the 10-meter long belt transect. The start location was at 0 meters and the quadrat was placed on alternating left and right-hand sides of the meter tape at every meter until the end of the belt transect (total of ten quadrates per belt transect). The start point (left or right-hand side of the tape was randomly chosen with the flip of a coin). Vegetative BRFIL was counted in each quadrat and then doubled for a total estimated BRFIL count per belt transect. These quadrat locations are permanent and the same quadrat location along each transect within each subplot was sampled for all three years. A direct flowering count was conducted in May 2007, 2008, 2009, 2010 and 2011. Species richness was also collected by recording all species encountered within each belt subplot. Percent cover by species was collected in each belt subplot using a 0.5 by 1 meter quadrat placed at random intervals on the right and left hand sides of a meter tape placed in the middle of each subplot. Three quadrats were read per belt subplot, and placement of the quadrat on either side of the measuring tape was determined with the flip of a coin. The placement of the quadrat along the 10-meter transect tape was chosen using a random number table. The quadrat contained 36 points, located when metal wires arranged within the quadrat intersected at one decimeter intervals, thus supplying 108 total points per subplot for estimating percent vegetative and ground cover. Vegetative cover was recorded by species. Ground cover was recorded as either bare ground or litter. Likewise, litter was characterized as former live vegetation lying directly on the ground as thatch, or rabbit droppings. Height and number of flower heads were also measured in each of the subplots in May 2008.

BRFIL scape height and number of flower heads were measured in 2008. The measured BRFIL were randomly chosen by placing a meter tape perpendicular at each meter interval along the 10-meter belt transect tape. Five of the closest BRFIL to that perpendicular tape at each meter were measured. After analyses were completed, it was determined that either height or number of flower heads could be measured as these two variables were highly correlated. As such, in May 2009, only BRFIL flowering height was measured. Twenty-five BRFIL were selected and measured within each treatment subplot in 2009. If twenty-five plants were not growing within each treatment subplot, then all of the plants in that treatment subplot were measured. All scapes for each selected plant were measured using a ruler. To accomplish this, a tape measure was stretched out in the middle of each subplot to run the length of each subplot. To avoid subjective choice, a ruler was laid out perpendicular to the subplot at every half-meter interval (.5, 1, 1.5, etcetera) along the tape. The closest BRFIL to the intersection of the ruler and measured interval along the tape was selected.

In 2010, the height measurement methodology was modified, because it was determined that our scape choice methodology was flawed. Using the closest to pre-determined point methodology was found to be a biased method of choosing replicates for measurement, and is discussed in Measuring and Monitoring Plant Populations (Elzinga et. al. 1998). In order to reduce subjectivity, all flowering BRFIL encountered within each treatment subplot within Macroplot 1 that contained less than 50 plants were measured. All flowering individuals in Macroplot 3 were measured, since flowering was not as dense as

in Macroplot 1. In Macroplot 1, where greater than 50 plants were flowering (the majority of subplots) quadrats were randomly placed throughout the subplots until fifty individuals were measured.

Dethatching of dried litter material occurred in October 2007, September 2009, and in early November 2011 for both Macroplots. In 2008 dethatching did not occur and in 2010, dethatching of only Macroplot 1 occurred. Dethatching occurred in the late summer or early fall so as to avoid affecting BRFIL during its vegetative, flowering, or seeding stages.

Statistical Methodology

Five attributes are being measured. These include percent cover, direct counts of vegetative and flowering BRFIL, species richness, and BRFIL inflorescence (scape) height. Average number of vegetative and flowering BRFIL was compared within and among both Macroplots, and the variation among blocks was also investigated. Average percent cover by category (litter, bare, cover by species), and average species richness by category (native, non-native) has been graphically explored, but no statistical testing has been performed to date on these measures. Repeat measures ANOVA was run on vegetative and flowering counts during fall 2011, and we expect to run repeat measures ANOVA analysis on scape length measures (height) at least by January 2012.

The potential effect of location had been accounted for by stratifying the random placement of experimental units throughout each Macroplot, (complete blocked design) at each of the three sites (however, only two Macroplot sites are now being monitored).

The null hypothesis is that there will be no difference between controls and experimental manipulation subplots. The null hypothesis will be rejected if there is a difference in any of the response variables categorized by treatment. The null hypothesis will be rejected if the resulting probability (p) that the results are due to chance outcome alone (thus likely not due to treatment) is less than 5 percent ($p < .05$).

Elzinga, Caryl L.; Daniel Salzer; and John Willoughby. 1998. Measuring and Monitoring Plant Populations. Bureau of Land Management. National Business Center. Denver, Colorado. July.

Appendix 4 - The Center for Natural Lands Management - San Diego: Coastal Sage Scrub Monitoring Plan

The Center for Natural Lands Management-San Diego: Coastal Sage Scrub Monitoring Plan (Revised in 2011)

Objective: Track the changes in structure and composition of the coastal sage scrub (CSS) community.

a. Use data to evaluate the structure and composition of the CSS vegetation community and its correlation to predictions of vegetation changes based on theories postulated by ecological and threats models.
b. Use data to evaluate changes or trends in "populations", presence/absence and/or occupied/unoccupied habitat of sensitive animal species, primarily the coastal California gnatcatcher (*Polioptila californica californica*)(CAGN).
c. Use data to evaluate changes in species richness.
d. Use data to evaluate changes over time from a baseline vegetation pattern.
e. Use data to guide vegetation management decisions (i.e. non-native plant removal, rare species range increases/introductions).

Background of Need:

The Center for Natural Lands Management (CNLM) manages several thousand acres of CSS in San Diego County. These areas host many threatened, endangered and sensitive plant and wildlife species, provide for wildlife movement and are some of the last remaining stands of CSS in coastal San Diego. These areas were also specifically designated as important areas to conserve under the regional Habitat Conservation Planning (HCP) conservation efforts.

As a result, the CNLM needs to be able to evaluate recruitment and vigor of this vegetation community over time to guide management decisions and to evaluate changes in plant and animal communities. This monitoring will also provide an opportunity to evaluate theorized predictions of changes in vegetation communities resulting from urbanization, non-native species invasion, global warming, increased edge, altered fire regime and fragmentation (to name a few).

Background of Ecological Model and Threats

CSS is a fire-adapted vegetation community with fires occurring naturally, but most severely under the extreme Santa Ana heat and winds of late summer and fall and during drought conditions. During these conditions there would generally be a "complete burn" where all above ground vegetation within the fire's path would be consumed. After such a fire, herbaceous plants (fire followers), which are known to sprout after fires, would dominate the landscape for a few years. Over time (3-5 years) the shrub lands would regain their dominance, and after 5-10 years a mature assemblage of plants and wildlife would again be found on site (Dallman 1998).

The fire frequency in CSS is as frequent as chaparral due to the volatile oils and resins that occur in CSS plants. The plants, such as white sagebrush (*Saliva apiana*), are able to resprout after a fire or produce many seedlings from the dormant seed bank that lies in the soil. Seed germination of some species may also be stimulated by fire (Holland and Keil 1995, Dallman 1998). However, if the fire frequency and intensity are too great, plants in the CSS community, such as black sage (*Salvia mellifera*) and California sagebrush (*Artemisia californica*) are permanently killed and can no longer regenerate, slowly converting the CSS community to a non-native, annual grassland (Southwest Division, Naval Facilities Engineering Command 1998).

Each CNLM preserve in San Diego has a different fire history and a different predicted fire future. For example, most of the Rancho La Costa (RLC) Habitat Conservation Area (HCA) burned in the Harmony Grove fire in October of 1996, while the Manchester HCA has not burned (except two very small fires) in its entirety since 1917. Prior to 1917 no data are recorded, so it is uncertain as to when the last significant fire event occurred in the Manchester HCA.

Regardless of fire history and the current vegetation characteristics, there are many realized or potential threats to the integrity of the CSS vegetation community (See RLC Habitat Management Plan CSS Ecological Model and Threats Section (CNLM 2005) that need to be evaluated including:

1. What is the effect of an altered fire regime at each HCA?
2. What is the potential effect of global climate change?
3. What are the effects of urban edge?
4. What are the effects of fragmentation and isolation?
5. What are the effects of altered wildlife usage patterns?

The answers to these threats questions lead to other questions that are associated with effects on ecological processes and patterns, such as:

1. Are the variables investigated representing a threat?
2. At what spatial scale are the variables representing a threat?
3. How do the effects of the threats listed above effect the distribution and abundance of sensitive plant and wildlife species?
4. How do the threats listed above effect the distribution of non-sensitive plants and animals?
5. How do the effects of each threat alter ecological processes?
6. How do the various measured factors interact?

Predictions

Fire. We predict that as a result of fragmentation, complete burns of preserves are now less likely and that there will be fewer, smaller fires resulting in a mosaic of CSS with various age structures.

Global Climate Change. We predict that rainfall patterns will change (likely decrease) over the next 100 years resulting in a lengthening of the fire season, increased frequency of lightening fires, increased frequency of drought, and areas burned. We predict:

1. Possible regime shifts (altered abundance and recruitment patterns in various native vegetation assemblages)
2. Altered invasion severity of exotic species due to changes from native-adapted variations in weather phenomena
3. Lowered native seedling survival of species due to changes from native-adapted variations in weather phenomena
4. Lowered seed and/or clonal production of future generations due to changes from native-adapted variations in weather phenomena
5. Negative interactions between native wildlife and changes resulting from the above mentioned predictions in vegetative cover

Habitat Fragmentation and Urban Edge. We predict that habitat fragmentation will reduce plant diversity and migration and/or genetic exchange between plant populations. This could affect the CSS community by reducing vigor within populations and eventually leading to extinctions of specific plant species. Habitat fragmentation has resulted in an increase of urban edge on all our preserves. We predict that this will result in increased pressures from non-native plant species, illegal vegetation clearing, dumping, erosion, and other threats that will change the vegetation structure and composition.

Monitoring Methodology

Approximately fifty plots will be established inside three of our preserves, and the number per preserve allocated by the amount of acreage currently occupied by CSS in each preserve. These plots will be placed in a stratified random manner across our preserves. Stratification will take into account:

1. Size of preserve
2. Slope and aspect
3. Distance from preserve edge/urban edge
4. Presence or absence of CAGN or San Diego horned lizard (*Phrynosoma coronatum blainvillii*)
5. Fire history

Plot Design and Setup

The original plot design was based on the Whittaker nested vegetation sampling design as in Stohlgren et al. 1995. The design of the Whittaker nested vegetation sampling plot deviated from that described in Stohlgren et al. 1995 by not including the 12 smaller 1-square meter rectangles. The dimensions of the modified Whittaker nested vegetation sampling Plot was 50 meters long by 20 meters wide. Three smaller nested plots were placed inside the sampling Plot, the largest of these three was 20 meters long and 5 meters wide, placed in the center of the sampling Plot, with the long axis corresponding

to that of the Plot. The two other nested plots were at opposite corners of the sampling Plot, and were 5 by 2 meters in length, again with the long axis corresponding to that of the sampling Plot. The long axis of the modified Whittaker plots were set to cross the environmental gradient present at the sampling Plot location. Sampling was carried out for both continuous variables (percent cover by species) and non-parametric and semi-continuous variables (count of dead shrubs, species richness).

The sampling Plot design was modified in 2011 after data analyses revealed that less area could be sampled within each Plot. The two, 5 by 2 meter nested plots were deleted from the sampling effort and the 5 by 20 meter center, nested plot was reduced in size to 2 by 20 meters.

Point Intercept Data (Percent Cover)

Percent cover by species was gathered by running a metric measuring tape along the upper border of each Plot. The point-intercept transects were standardized to read hits at half meter intervals, thus generating 99 "hits" along the long (50 meter) side of the Plot. Living plants were counted as a point or "hit," if a 1.5 millimeter dowel is intersected in the vertical plane by the living tissue of a plant. At each half meter, data pertaining to bare ground, rock, or litter incident with the dowel was also collected. Dead branches attached to a living shrub do not count as a "hit." If a completely dead shrub is incident to the dowel along the point intercept line, that shrub is noted by species (if possible) in a separate column from the living plant "hits." The hope is that this may generate information pertaining to large-scale shrub die-off, as has been recently noticed, but had gone quantitatively undocumented in the Rancho La Costa HCA.

The point-intercept transect measures will provide a method of quantifying change in abundance by species and edaphic cover that may also tie into species richness changes observed within the center, sub-plot. For instance, non-native grasses and/or litter cover changes may be predictive as explanatory variables in a multi-factorial analysis of the response variables mortality or species decline. Other variables that may be tied into a model explaining the measured pattern may include regional rainfall totals for the season and/or seasonal temperature averages, slope and aspect of Plots, fire history, and the presence or absence of animal herbivory.

Species Richness

Species richness was originally gathered inside the three, nested subplots located inside each Plot; however, as discussed above, in 2011, species richness was only collected in the nested center plot that was reduced in size from 5 by 20 meters to 2 by 20 meters. Each species occurring within the center plot was recorded. Plants were identified to species and subspecies whenever possible.

The data collected in the center plot will be useful in generating species area curves and (more importantly) in documenting species presence or absence, as well as recruitment and mortality over time.

We obtained shrub counts in our nested subplots and in the Plot during our first year of sampling (N = 17 Plots), and found that any counting inside subplots and the Plot, in addition to noting species richness cannot be supported on our HCA endowments. Collecting species richness in these subplots is the most time-consuming portion of each visit.

Sampling intensity

CNLM met with Dr. Douglas Deutschman at San Diego State University to inquire into methods of maximizing our return from our effort. We could not afford to monitor more than approximately 20 Plots per year. Also, the effects of trampling could mislead our conclusions about trend over time if we re-visited the same sites every year over the course of many years. It is necessary to capture the yearly variation in conditions such as rainfall and temperature, and thus we knew that many replicates would be needed in order to capture meaningful patterns.

Dr. Deutschman suggested a "rotating panel" approach. This approach incorporates visiting a subsample of all Plots on a yearly basis, ensuring to balance the replicates according to aspect and to spread these replicates across the landscape in order to capture variation in weather or rainfall that may take place across our sample region. It was suggested that we re-visit eight Plots over the course of three years, while rotating 12 or more new Plots over the course of the three years. Thus, after the third year of sampling, 45 plots have been visited, and the variation in measures among the eight re-visit Plots can be compared to the rotating Plots. In this manner we can judge if yearly re-visits are necessary in the long-term, or if more sites are needed each year.

For instance, one potential outcome is that the region in which we are sampling does not vary substantially in factors influenced by weather or disturbance, and that by stratifying sub-sampling across the region and visiting a subsample of the whole, we can adequately capture the variation in vegetative and species richness measures without overtaxing our annual budgets. Another potential outcome is that we will obtain substantial information from this rotating panel design to indicate how many more sites should be visited on a yearly basis to capture the yearly variation without visiting the entirety of our plots.

Analyses and sample size

CNLM again met with Dr. Deutschman in late 2011 to review data gathered over the course of the three consecutive years since collection began in 2009. Another meeting is scheduled for early December 2011 as of this writing. The considerations under his cognizance are how many Plots are needed in order to gain *X* percent certainty that *X* change in particular vegetation functional group cover (exotic forbs, exotic grasses, etc.) is occurring while maintaining affordability of sampling effort. This is at face value a sliding scale scenario whereby the most sensitive measures (non-native grasses and native forbs) determine how precise our estimates should be, and affordability also helps determine the precision of both the percent change that is meaningful and the desired

precision. The second meeting in December 2011 should help us further refine the most desirable yearly sample size for these most sensitive response variables. Based on power analyses based on the t statistics generated in the paired t tests, for the repeat plots that were performed for three consecutive years, it would appear that a minimum of 12 separate plots will need sampling every year, on a three or four year return interval. We are unsure at the moment how many to visit yearly, but will know soon. Table 1 below contains some basic statistics of a combination of the yearly repeat visit plots and the rotating plots also read, and thus totals to 60 plots altogether. Note that the variability of both exotic forbs and native grass cover relative to the other categories (the basic utility of the coefficient of variation) is much higher.

Table 1. Summary statistics for all plots 2009-2011, including repeat plots.

	Exotic forb	Exotic grass	Native forb	Native grass	Native shrub
N of Cases	60	60	60	60	60
Minimum	0	0	0	0	4
Maximum	42	62	56	29	87
Arithmetic Mean	6.767	12.7	9.75	4.4	45.567
Standard Deviation	11.115	12.163	10.042	6.559	19.793
Coefficient of Variation	1.643	0.958	1.03	1.491	0.434
Effect 20% of Mean	1.3534	2.54	1.95	0.88	9.1134

The basis for comparison in rotating sampling plots is necessarily a paired design whereby each unit gets compared to itself upon reaching the second return sampling event and thenceforth with every subsequent return. Each shape and corresponding color in Figure 1 below refers to a set of plots where data are collected on a given year. The paired comparisons will take place between years; since variation in the measures performed thus far indicate that spatial variability among plots is much greater than year-to-year variability among plots. To put it another way, plots are very dissimilar to one-another in cover and representation of this cover by shrubs, grasses, and forbs, and these measures don't change as much year-to-year as they do differ from one-another from site to site.

Figure 1. Rotating css plot analysis diagram. Each symbol represents a set of plots measured in a given year, repeating at regular intervals and analyzed using paired repeat measures methodology.

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